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The development and present status of biology as taught in the public secondary schools of Massachusetts.

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The Development and Present Status of Biology as Taught in the Public Secondary Schools of Massachusetts

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THE DEVELOPMENT AND PRESENT STATUS OF BIOLOGY AS TAUGHT IN THE PUBLIC SECONDARY SCHOOLS OF MASSACHUSETTS

Morton Harding Cassidy

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Grateful acknowledgment is made to all who have furnished data. In particular should be mentioned Mr. Frank P. Morse of the Massachusetts Department of Education who made available the biennial reports upon which much of this has been based.

Recognition is also due to the three veteran teachers, Mr. Ralph C. Bean, Mr. George D. Bussey, and Dr. W. H. D. Meier, who have been freely quoted as to the early status of biology in the Massachusetts schools.

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INTRODUCTION

PRESENT DAY CONFUSION IN SECONDARY SCHOOL BIOLOGY INSTRUCTION

The early years of the present century mark a very general readjustment of the secondary school curriculum to meet the needs of our changing civilization. Through the entire list of subjects taught in 1900 there have been marked changes both in subject matter and in the method of presentation. In this regard modern students of education are nearly all agreed that there has been more progress in the field of Education in the last ten years than in all previous history. This progress has been nowhere more evident than in the natural and physical sciences. The situation in the physical sciences has been the first of these to clarify and the result seems to be a course in General Science. This is very generally placed early in the curriculum and often has been made a required subject so as to reach a larger number of pupils. General Science is now a well recognized and fairly stable subject with revisions only where the advance of science makes them necessary.

Biology Slow of Adjustment

The standard form in which biology was taught for many years was under the three specialized subjects of botany, physiology, and zoology.

Although these have suffered an earlier and even sharper drop in enrollment than the physical sciences, their modification has been much slower to meet the needs of today. Their condition may still be considered as one of flux. There is no general agreement among textbook writers or teachers as to what should be included in a high school course in biology. Some schoolmen are opposed to such a general course on the ground that biology is only a smattering of a number of different subjects. Also, some opposition has been made because the colleges do not offer credit for biology toward entrance while the old line subjects of botany and zoology are accepted.

Massachusetts Schools Among the Slowest

The progress of biology in Massachusetts schools has been particularly slow as compared with that of New York State for example. No definite aims have been set up for the state of Massachusetts as a whole. Among the cities the nearest approach to a standardized course of study is a syllabus of suggested topics used by the public schools of the City of Boston. An analysis of the courses offered in various schools indicates that what is taught in biology is very largely determined by the individual teacher and there is no uniformity of practice.

Resolution of the Problem

It was the lack of definite aims in biology that prompted this study. If biology is to replace the specialized sciences as now seems likely it is desirable that a philosophy for biology be established. The history of the subject should be known and causes of important changes ascertained. More data than is now available is necessary if these ends are to be achieved.

The Problem Defined

The very mixed situation in which biological study is found challenges the interested teacher to know how and why this condition has come about. The problem presented by the conditions has led to this study the purpose of which is to trace the development of biology from the specialized sciences to its present position as a unified subject in the public secondary schools of Massachusetts. It is further intended to determine the cause of important changes that have been made. For a clearer understanding of the present status of biology the study includes an analysis of such related factors as biology included in general science, in textbooks, and in college entrance requirements.

Because the growth of biology in Massachusetts has been more or less spontaneous and because it has not been sponsored by the State Department of Education, as is the case in neighboring states, it is within the province of this study to draw some of its data from outside sources.

Similarly there will be tangential data from related subjects, all of which illumines the situation in Massachusetts.

Procedure

Search of Literature

A careful search of the field has failed to reveal any literature bearing directly upon the topic of biology in Massachusetts schools. This search has extended through the libraries of the Massachusetts Department of Education and of the Harvard Graduate School. Further inquiry has been made of the veteran teachers, Mr. Ralph C. Bean, Mr. George D. Bussey, Professor H. Henry Black, and Dr. W.H.D. Meier and it is their united opinion that no such information exists. There are scattered bits of information bearing upon the situation over the entire country which will be here included.

Determination of Early History

Because of the lack of written records the early history of biology in the high schools was determined largely by a discussion of the subject with teachers who taught through the transition stage of specialized science to biology. Some of these teachers interviewed have been mentioned in the preceding paragraph.

To verify the opinions of these teachers a further study was made of the textbooks known to

have been in general use during the early days of biology. These invariably contained in the preface a statement of aims and they are quoted on a later page.

Determination of Present Status

The present aims of biology were determined in much the same manner. First, it was ascertained which of the current biology texts are in general use in Massachusetts. This information was obtained from the publishers and checked for reliability. Next, the books in general use were analyzed for subject matter.

Last, a search was made for courses of study in use by the larger communities of the state in anticipation that some might be found to throw light upon the present content of biology.

Disclosures of the Biennial Reports

The most fruitful source of information was the file of biennial reports of each high school in the state as required by the Massachusetts Department of Education. These are available for the last eight years and revealed the number of pupils engaged in the study of each subject, the number of hours per week spent upon the subject, and the year each subject is offered.

Study of General Science Texts

It was apparent at the outset that much biology material is taught in general science courses. In the belief that this would have some bearing upon the problem, quantitative analysis of material in nineteen general science texts was made and the results recorded under the heading of related factors.

Study of College Entrance Requirements

As is the case with many high school subjects, what is taught in biology is often influenced by what is acceptable to the colleges for entrance credit. Consequently the study includes an analysis of these requirements as well as an investigation into the number of colleges that accept biology for entrance. Both of these findings have been included under the heading of related factors. In this same connection the yearly examinations in biology of the College Entrance Examination Board have been analyzed for more light on the development and present status of biology.

Review of Literature

Origin of the Term "Biology".

In its modern sense, biology did not appear in the curriculum until about 1860,[1] when the unity and nature of plant and animal protoplasm were first clearly demonstrated by Max Schultze (1825-1874). For this evidence of the likeness and fundamental relationship of living things Schultze is called the Father of Modern Biology. Credit must also be given to Lamark (1744-1829) and to Treviranus (1776-1837) for establishing the unity of life and for coining the word "biology" about 1803. Biology as a unified science of living things was brought to this country in 1876 by Huxley.

Entrance of the Natural Sciences into Secondary Schools

Inglis in his book, Principles of Secondary Education,[2] notes that: On the whole, three periods in the development of the study of natural science in the secondary school are to be distinguished. During the first period (about 1800-1870) the natural

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[1] D. Baird, A Study of Biology Notebook Work in New York State, 1929, p. 2.

[2] A. Inglis, Principles of Secondary Education, 1918, p. 509.

sciences were studied and organized largely as informational courses. During the second period (about 1870-1900) the tendency was to organize the study of the natural sciences according to the demands of pure science. The third period (about 1900 to the present) has been characterized by attempts to organize the study of natural sciences in part according to their applications. The movement, however, is as yet (1918) in its formative stage.

The academies of New England and the Middle States were the first to offer credit courses in botany and zoology. Botany was offered in the academies as early as 1795 and zoology 1818. The University of Michigan accepted both botany and zoology as entrance requirements in 1873. Botany as a high school subject appeared in the Boston High School for girls in 1826; human physiology at Ipswich in 1839; and zoology at Waltham in 1849.[1]

Biology Appears

The precise date when biology appeared in its modern sense as a unified subject in Massachusetts schools is not clear. This is due to the confusion

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[1] Downing, Teaching Science in the Schools.

that still persists as to the definition of the term. However, veteran teachers are agreed that the date was about 1910. Biology first appeared in the high schools of New York State about 1905, followed by the first Regents examination in this subject in June, 1906. The College Entrance Board offered the first examination in biology in 1914.

Failure of Physiology to Meet Present Needs

There is abundant evidence that the specialized biological sciences did not meet with wholehearted approval or success. To quote,[1] "Much of the physiology taught the last forty or fifty years has been of very little use in actually helping to promote good health habits. Certain facts of anatomy may be of use in teaching proper breathing, digestive functioning, and posture; to know the number and names of bones and muscles may to a certain extent satisfy curiosity; physiological knowledge may aid toward a realization of the importance of good health, but none of these guarantees more healthful living."

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[1] School Hygiene Series #4, Mass. Dept. of Public Health, 1931.

Failure of Botany and Zoology

What was true of physiology seems to have been also true of botany and zoology.[1] "The teachers of morphological biology in the schools brought with them from the college certain ideas of method. Possibly the lecture system never took strong hold in the schools, but the laboratory method of the college, with much of its paraphernelia, did. The consequence of this was that thousands of young, untrained pupils were required to cut, section, examine, and draw the parts of dead bodies of unknown and unheard of animals and plants and later to reproduce in examinations what they remembered of the facts they had seen."

Summary of Review of Literature

These quotations from the literature on the history of biology establish the following facts: (1) The term "biology" is an old one (1803) used to describe the study of living things; (2) the biological sciences have been offered in various

[1] Linville, H.R., "Old and New Ideals in Biology Teaching." School Science and Mathematics, X: 210-216, March, 1910.

forms in the United States since 1800; (3) biology as a distinct subject did not appear in the public secondary schools until 1910; (4) the change to biology was occasioned by the failure of the old line sciences; and (5) the change to biology is still in progress.

Procedure

Scarcity of Data Concerning Biology in Massachusetts Schools

The procedure in this phase of the study has been, first, to search the literature bearing upon the situation of biology in Massachusetts. The search has extended through the library of the Harvard Graduate School of Education and through the library of the Massachusetts Department of Education. No specific information has been found that bears directly upon the subject of biology in Massachusetts public schools. It is the conclusion that none exists. Some data is available on the specialized natural sciences for the United States at large and this is summarized in Table I.

The Spread of Biology

It is felt that the spread of biology through the secondary schools of the state could best be ascertained by a study of the enrollment over as long a period of years as possible. By a comparison of these figures with similar ones for the specialized sciences some conclusion may be arrived at as to whether biology actually is replacing any other studies or not.

To get the increase in enrollment in biology an examination was made of the biennial reports of the Massachusetts State Department of Education. This necessitated an examination of the report of nearly all of the high schools in the state for the last eight years. The number of students enrolled in each natural science was noted and is recorded in Table IV. (Because of the bulk of data included it is placed at the back of the volume and a summary of it only included here).

Omission of Data on the City of Boston

Inasmuch as this study has been made to discover the development and present status of biology over the entire state it is deemed best to

consider the tendency of the City of Boston in a separate section. Otherwise the situation in Boston, because of its great population, would overshadow that of the rest of the state and prevent a true picture of conditions. The best available data on Boston is found in School Document #18-1923 of the Boston Public Schools.

Position of Biology in the Curriculum

The position of biology in the curriculum was determined from the biennial reports of the high schools of the state. There are 251 high schools in the state including those in Boston, but for reasons detailed in the preceding paragraph the data from Boston is omitted. Also, there are a few (not over twenty) reports missing from the 1930-1931 survey because of incomplete returns when this data was collected (April, 1931). In all, data here offered has been collected from 932 reports.

Development of Content

In the study of the development of content considerable difficulty was experienced because in the first years of the subject there were no standardized courses of study to furnish a record. The few textbooks available about 1910 are sketchy and it is impossible to ascertain to what extent they were used in Massachusetts. The procedure, then, has been to consult veteran teachers of biology for their opinions as to the content of the subject in its early days. These have been quoted on a later page.

The present tendency has been determined by an examination and analysis of the texts now in Massachusetts. (Table V).

To determine the biology texts now in common use by the schools of the state the publishing houses were consulted. They have on file the names of schools using their texts and were most generous in the offer of assistance. Furthermore, claim to the circulation of their particular text was found to be conservative as a casual check-up of certain schools later proved.

Attitude of the Colleges

Under the heading of Related Factors has been put the history of the changing attitude of the colleges. This means the acceptability of biology for college entrance credit. This procedure has been determined by a questionnaire to all of the colleges and universities of New England.

Biology in General Science Texts

It was found that considerable biology is taught in general science courses throughout the state. To arrive at some conclusion as to how much biology is thus taught all of the general science textbooks to be found in the library of the Harvard Graduate School of Education were subjected to an analysis. In all, nineteen books were so treated. Because there are no sharp lines separating the fields of science much of the material in these books could fall into more than one classification. The material was arbitrarily placed into one group or another and it is felt that the analysis while not exact will be accurate enough for present purposes. Because of the probability of slight inaccuracies in the analysis the names of the various texts are not associated with their data.

Supercedure of the Specialized Sciences

Restricted Meaning of "Biology"

Because "biology" as a subject in secondary schools has come to have a restricted meaning there has been some difficulty in obtaining accurate information concerning it. In its literal sense biology has been taught in Massachusetts schools since 1826 when botany was offered in the Boston High School for Girls. However, the meaning of the term in this paper is to be taken as "a unified science of living things."

General biology as we now understand it is more than a consolidation of courses in botany, physiology and hygiene. Summarized, it teaches that all living forms are the results of physical influences which are still in operation.

Decline of Physiology

The first of the specialized sciences to suffer any sharp decline in enrollment was physiology.

From an examination of the accompanying table (p. 18), it is seen that in 1900 physiology was the most popular of the sciences in point of enrollment. However, from that time on it has suffered the sharpest

TABLE I

STUDENTS ENGAGED IN NATURAL SCIENCE SUBJECTS IN PUBLIC HIGH SCHOOLS

	1900		1905		1910		1915	
	Students	% of Total	Students	% of Total	Students	% of Total	Students	% of Total
Astronomy	14,435	2.78	8,307	1.22	3,915	.53	3,224	.28
Botany					124,380	16.83	106,520	9.14
Chemistry	40,084	7.72	45,980	6.78	50,923	6.89	86,031	7.38
Gen. Biology							80,403	6.90
Geology	18,743	3.61	15,914	2.34	8,538	1.16	5,558	.48
Phys. Geog.	121,335	23.37	146,275	21.52	142,948	19.34	169,911	14.58
Physics	98,846	19.04	106,430	15.66	107,988	14.61	165,854	14.23
Physiology	142,401	27.42	149,262	21.96	113,252	15.32	110,541	9.48
Zoology					59,253	8.02	37,466	3.21

Data for year 1928 follows on page 23 and all together are plotted on page 24.

Beginning with 1910 the percentage of students in each study is based upon the number of students in the schools reporting studies. In previous years the percentages were based upon the total number of students in the schools.

1928

	Students	% of Total
Astronomy	2,045	.07
Botany	50,611	1.61
Chemistry	230,020	7.31
Gen. Biol.	418,121	13.30
Geology	2,816	.09
Phys. Geog.	81,807	2.60
Physics	224,233	7.13
Physiology	85,276	2.71
Zoology	24,184	.77
General Science	532,314	16.93

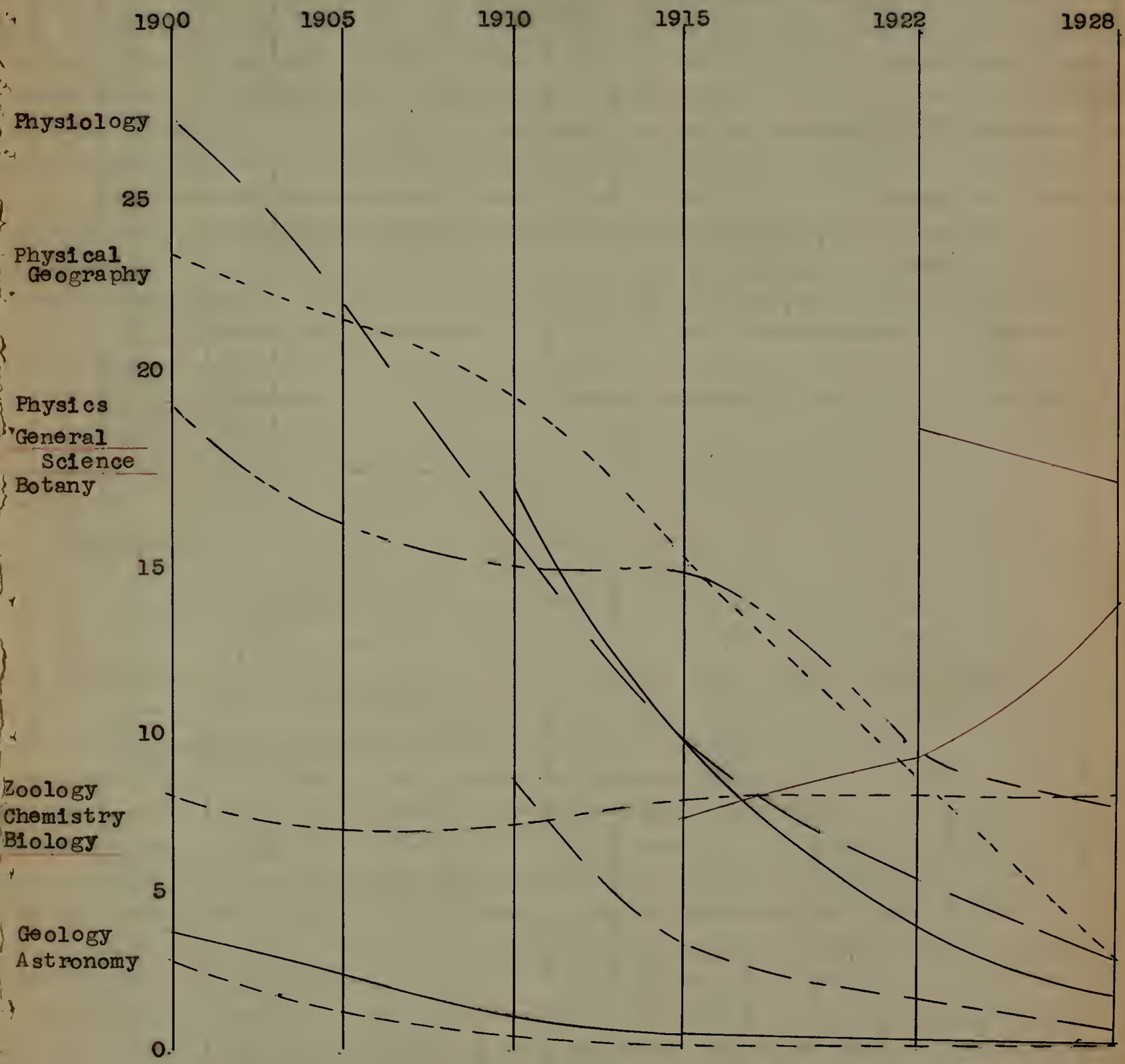
From Statistical Summary of Ed. 1927-1928

Bulletin, 1930, No. 3

U.S. Dept. of the Interior

Figure I

Enrollment in the Sciences 1900-1928



Vertical axis indicates per cent of students of high school enrollment pursuing the subject.

decline so that today it is taken by less than three per cent of the secondary school pupils of the United States. The only subjects with a lower enrollment number are astronomy, botany, geology, and zoology. As one writer puts it,[1] "Much of the physiology taught the last forty or fifty years has been of very little use in actually helping to promote good health habits."

Physiology Required by Law

That physiology persisted as a prominent school subject as long as it did was probably due to two reasons. The first of these is found in the Massachusetts General Laws Relating to Education[2] which state ". . . schools . . . shall give instruction and training in . . . physiology and hygiene. In connection with physiology and hygiene, instruction as to the effects of alcoholic drinks and of stimulants and narcotics on the human system, and as to tuberculosis and its prevention, shall be given to all pupils in all schools under public control, except schools maintained solely for instruction in

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[1] School Hygiene Series, #4, Mass. Dept. of Public Health, 1931.

[2] Bulletin of the Dept. of Ed., 1927, #4, p. 15.

particular branches." In all probability this accounts for the few cases where physiology is still taught in some Massachusetts schools. An analysis of biology texts (Table II) indicates that the requirements of the law is adequately met by biology.

Influence of Religious Organizations

The second reason for the persistence of physiology, at least until 1900, was the influence of certain religious organizations upon school curricula. The influence of this propaganda is shown in an indorsement for Steele's Hygienic Physiology, which reads:

Boston, June 20, 1889.

The Pathfinder Series of Textbooks on Anatomy, Physiology, and Hygiene consists of the following volumes:

I. Child's Health Primer (for Primary Grades).

II. Hygiene for Young People; or, Young Peoples Physiology (for Intermediate Classes).

III. Hygienic Physiology (for Advanced Pupils).

The above are the series originally prepared (as their general title indicates) to supply the demand created by the laws for temperance instruction

in public schools in the United States. They were written by experts under the supervision of the Scientific Department of the National Woman's Christian Temperance Union, published by the instigation of the same, and have been carefully revised from time to time, under the same supervision, to keep them abreast with the latest teachings of science.

Being both teachable and well adapted to grade, their educational value, as proven by school room tests, is of the highest order. We therefore cordially indorse and highly recommend the Pathfinder Series for use in schools.

MARY H. HUNT

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The Change in Emphasis from Anatomy to Health and Sanitation

From an examination of the texts in use at that time it is evident that in its early history in our secondary schools physiology was largely concerned with anatomy. Today we find the anatomical aspects greatly reduced with health and sanitation in greater prominence (see Chart VII). In spite of these revisions it is very evident that by 1915 (Chart II) physiology had a very much reduced enrollment.

The Decline of Botany and Zoology

Data upon botany and zoology is not available for the United States at large prior to 1910. However, we find a sharp decline in student enrollment from that time on (Chart IV). For further information we are obliged to draw upon educational writers of that time.[1] We find that in the case of botany the older morphology was taught, and the classification of plants was the chief subject of botanical investigation.

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[1] Coulter, John M., "Chapters in the History of American Botany." School Science and Mathematics, XI: 814-16. December, 1911.

TABLE II

SUMMARY OF INVESTIGATION FROM OTHER STATES

Date of Report	Investigator	Territory	No. of Schs.	% of Schools Pursuing Biology	Botany	Zoology	Physiology
'15	Downing	U. S.	128	0.0	63.3	56.3	28.1
'18	Jones	S. D.	124	4.8	30.6	3.1	4.0
'19	Worun	Mich.	172	10.5	29.6	8.7	4.7
'22	Holmquist	Minn.	109	30.0	28.0	30.0	25.0
'24	Downing	Ill.	175	22.2	78.8	70.0	65.7
'24	Foster	Wash.	155	43.1	40.6	9.7	14.2
'24	Hunter	U. S.	357	83.8	29.9	8.7	4.7
'24	Bailey	Cal.	316	39.5	10.1	5.2	13.3

TABLE III

PUBLIC SCHOOLS OFFERING NATURAL SCIENCES IN MASSACHUSETTS 1924-1931

Date of Report	Investigator	Territory	No. of Schls.	% of Schools Pursuing Biology	Botany	Zoölogy	Physiology
'24-'25	Cassidy	Mass.	235	62.9	8.0	3.4	8.9
'26-'27	"	"	232	57.2	7.3	2.2	14.7
'28-'29	"	"	235	70.2	8.1	3.8	14.5
'30-'31	"	"	207	77.3	5.8	3.9	14.0

Note. Table IV a summary of Table XIII.
The biennial report incomplete
3/9/31 the reduced no. of schools.

A Religious Aim of Botany and Zoology

Further reason for the decline of botany and zoology is found in faulty aims held for them prior to 1900. One of these was a religious aim. The introduction to the text used almost exclusively until 1895[1] contains:

"Consider the lilies of the field, how they grow; they toil not, neither do they spin; and yet I say unto you that even Solomon in all his glory was not arrayed like one of these--Matthew VI:28-29. Our Lord's direct object in this lesson of the lilies was to convince the people of God's care for them. . . . And when Christ Himself directs us to consider with attention the plants around us, to notice how they grow, how varied, how numerous, and how elegant they are and with what exquisite skill they are fashioned and adorned, we shall surely find it profitable and pleasant to learn the lessons which they teach."

Scientific Habit of Mind Ascribed to Study of Botany

Still another faulty aim is found in the text of Bergen: "Another claim of the botanists prior to 1900 was that botany will develop a scientific habit of mind if the pupil in

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[1] Stout, John Elbert, The Development of the High School Curricula in the North Central States from 1860 to 1918. Ed. Monograph, June, 1921, The U. of Chicago.

his notes and recitations is required to distinguish clearly the sources of his knowledge."[1] Modern educators are agreed that no such habit of mind can be developed by a study of botany.

Early Changes in Zoology

For an insight into the early days of zoology instruction a treatise on "The History of Zoölogy Teaching in the Secondary Schools of the United States"[2] throws indirect light upon the situation in Massachusetts. In it is stated that "about 1825, zoology first made its way into the curriculum. In aim, subject, and method it resembled but slightly the zoology of the present. Its intrinsic value of broadening and training the mind was no part of the purpose of its introduction, but rather to acquaint children with the works of the Creator and inspire them with love and admiration for a Being who could and did create such great and wonderful things for the children of men."

Second Stage in Teaching Zoology

"The second stage in the teaching of zoology in secondary schools witnessed the emphasis on comparative anatomy, anatomical structure and

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1
Bergen, J.Y., Elements of Botany, Ginn and Co., 1896, Appendix.
Appendix

2Brown, Marion R., "The History of Zoölogy Teaching in the Secondary Schools of the United States."
School Science and Mathematics, II: 201-09; 252-72, 1902.

classification. The earlier desire to bring pupils nearer to the Creator had not entirely passed away, but the earlier religious ideals had been replaced by a more practical aim."

From the data supplied by the United States Commissioner of Education (Table I) it is evident that by the year 1915 the specialized sciences had lost much of their popularity over the country as a whole. The year 1915 also marks the first recognition of the new subject of general biology, by the United States Commissioner of Education.

It is seen from the graph on the enrollment in the sciences (1900-1928) that in 1900 there was a steady decline in all science enrollment. For some unknown reason data on both botany and zoology is lacking prior to 1910 but judging from the trend of all curves shown it is a fair assumption that this decline had been in progress for some time.

Reasons for the General Failure of Specialized Sciences

Various reasons have been ascribed for this general decline of the specialized sciences, one of which is contained in the following quotation.

"The truth is that all of the old recognized sciences failed some years ago to command respect of students of education when regarded as educative materials which would best equip the pupil to take his place as a prosperous and self-respecting citizen in this twentieth century world."[1]

The Rise of General Biology

It is not until nine years later 1924 that we are able to supply statistical information concerning Massachusetts (Table IV). It is worthy of note that the percent of schools pursuing biology in this state has increased steadily for the past eight years at the rate of approximately two per cent each year. Also, the number of pupils engaged in the study has had a proportionate and steady increase. The number of schools that offer the specialized sciences has remained fairly static but the number had already been reduced to a low figure before 1924.

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[1] Barber, F.D., "The Reorganization of High School Sciences." School Science and Mathematics, XVIII; 247-62, 1918.

TABLE IV

ENROLLMENT IN THE SCIENCES
IN MASSACHUSETTS

1924-1931

	Biology	Botany	Zoology	Physiology-Hygiene
1924-25	7,017	1,373	252	1,677
1926-27	8,254	1,116	279	2,698
1928-29	9,753	1,550	407	2,303
1930-31	11,437	1,105	523	3,138

1924-25 1926-27 1928-29 1930-31

Pupils Engaged in Study of Biology

Data from Biennial Reports

Figure II

Natural

Enrollment in the Sciences

in Massachusetts

In the compilation of the data on science enrollment in Massachusetts, it was noted that there was an occasional school that offered astronomy, geology, or horticulture. The number of schools so affected was never in excess of one per cent and the number of pupils concerned was proportionately small.

For present purposes, then, it may be safely assumed that the once popular subjects of astronomy and geology had disappeared from our public secondary schools by 1920.

The Place of Biology in the Curriculum

In the report of the Commission on the Reorganization of Secondary Education[1] it is recommended that in four-year high schools a course in biology be given in the second year and that in the junior-senior high schools this subject be given in the last year of the junior high school, and that in large schools other biological sciences be offered as electives in later years of the high school.

Located in the Second Year

From an examination of the data on Massachusetts schools it is seen that there is a well established tendency to put the subject in the tenth grade, (Chart # V), i.e., the second year of the four-year high school. Also, it is found from the same source of information that there is a marked tendency in the group of smallest high schools to vary the position in the curriculum between the first and second years. This accounts for the appearance of biology in alternate years in certain of the small schools. "In the smaller high schools, general science and biology are frequently taught on

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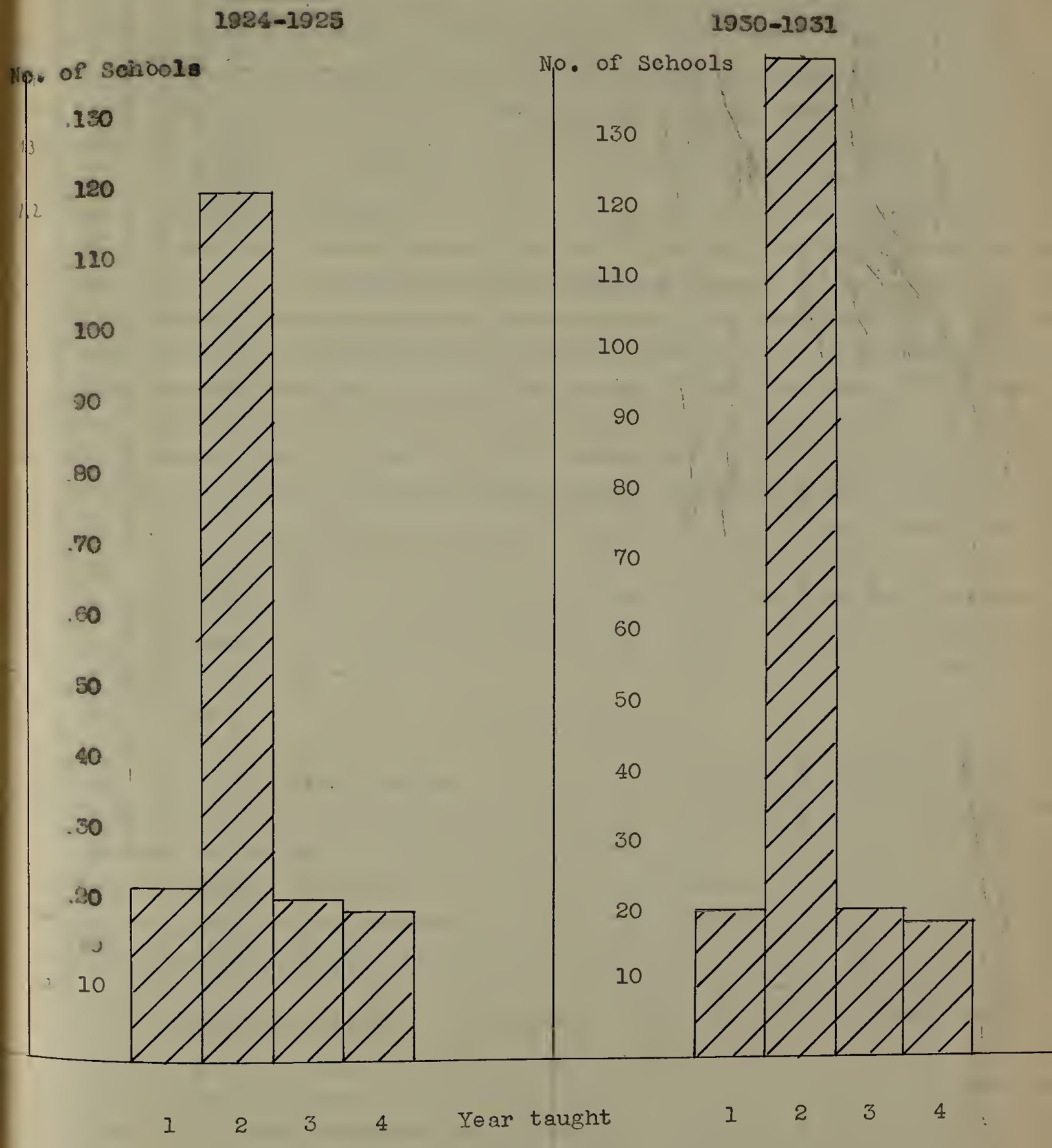
[1] Dept. of the Interior bulletin #26, 1920, p. 29.

Figure III

The Place of Biology in the Curriculum



alternate years to freshmen and sophomores combined. In larger schools both courses are taught each year, usually with general science for freshmen and biology for sophomores, although this order is sometimes reversed."[1]

Relatively Few Advanced Courses

Contrary to the recommendation of the Department of the Interior bulletin #26 there are but ten high schools in the state that offer either botany or zoology after the foundation course in biology. There are somewhat more schools (Table IV) offering physiology and hygiene but it is felt that this is to meet the requirement[2] of the state law.

Time Allotment

With regard to the time allotment to biology there is a very general tendency for the subject to be taught five periods each week (Figure IV). This information obtained from biennial reports is not entirely satisfactory because "periods" may differ in length. However, from general observation it is thought to mean approximately forty-five minutes.

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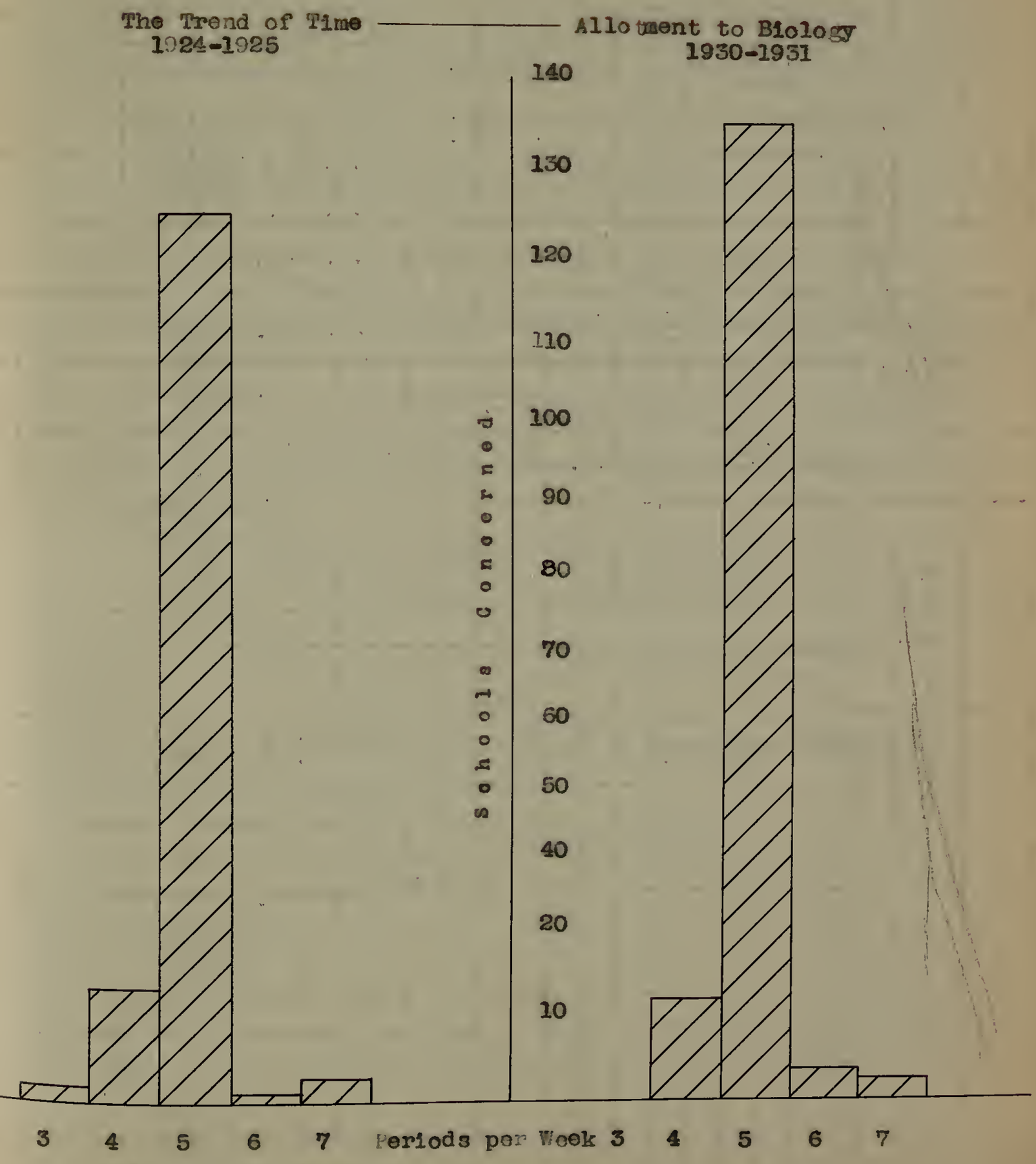
[1] Biology in the Rural High School, Committee on Science for Agricultural Pupils in Mass., 1928, p. 1.

[2] General Laws Relating to Education, The Commonwealth of Massachusetts, Bulletin of the Department of Education, 1927, #4, p. 15.

Figure IV


The Trend of Time
1924-1925
Allotment to Biology
1930-1931
140
130
120
110
100
90
80
70
60
50
40
20
10
Schools Concerned
3
4
5
6
7
Periods per Week
3
4
5
6
7

The Changing Content of Biology

Because the biology of the early days in Massachusetts high schools was inclined to vary as to content we are again obliged to draw upon the textbooks for the first idea of content. To ascertain which texts in biology were used about 1915 three of the outstanding teachers of that day were consulted. They are Mr. Ralph C. Bean of the Girls High School, Boston; Mr. George D. Bussey of the East Boston High School; and Dr. W. H. D. Meier of the Framingham Normal School. There is agreement among them that the earliest texts used were:

Elements of Biology, by G. W. Hunter
American Book Co., 1907.

First Course in Biology, by Bailey & Coleman
Macmillan, 1909.

Introduction to Biology, by Bigelow & Bigelow
Macmillan, 1914.

Civic Biology, by Hodge and Dawson
Ginn, 1918.

Aims of Textbook Writers

The aims of these authors are best brought out by a study of the introductions to their texts. These follow in the same order as given above:

Elements of Biology
by G. W. Hunter
A. B. Co., 1907

P. V. "The aim of this book is to correlate the allied subjects of botany, zoölogy, and human physiology in a general course of biology for the first year of the high school. The foundation principles upon which this correlation is made are that the life processes of plants and of animals are similar, and in many respects, identical; that the properties and activities of protoplasm are the same whether in the cell of a plant or of an animal; and that the human body is a delicate machine built out of that same mysterious living matter, protoplasm. With such a foundation correlation is not only possible, but natural."

Clear Cut 3 Parts

Botany	178	pages
Zoölogy	139	"
Human Phys.	112	"

First Course in Biology

by Bailey & Coleman
Macmillan, 1909

P. V. "The present tendency in secondary education is away from the formal technical completion of separate subjects and toward the developing of a workable training in the activities that relate the pupil to his own life. In the natural science field, the tendency is to attach less importance to botany and zoölogy and physiology as such, and to lay greater stress on the processes and adaptations of life as expressed in plants and animals and men."

P. V. "One of the marks of this new tendency in education is the introduction of unit courses in biology in the secondary schools, in the place of the formal and often dry and nearly meaningless isolated courses in botany, zoölogy and physiology."

Plant biology	204 pps.	
Animal "	223 "	
Human "	164 "	3 Distinct Parts

Introduction to Biology

by Bigelow & Bigelow
Macmillan Co., 1914

Prof. V. "This book is not a combined text-book of botany and zoology, for it makes no attempt at a systematic presentation of either of these sciences. It is simply what its title suggests; an introduction to biological facts and ideas.. . . This book ought to prepare for, rather than wastefully to anticipate, strong courses of botany or zoölogy which in many high schools will probably be offered as electives in later years."

Biol. 9, 13, 120

Bot. 53

Zoölogy 71

Physiology 76

Hygiene 72

Civic Biology

Hodge and Dawson
Ginn, 1918.

383 pps.; 32 chapters of unrelated material put in no logical order.

It will be noted from the analysis of these texts that the two older ones are divided clearly into sections of botany, zoology, and physiology. The two later texts show clearly the trend away from separate biological sciences to the blended type. This is in accordance with the findings of a study made in Texas, which follows

Two Types of Courses

"Two types of courses (general biology) are distinguished.[1] One is the treatment of the course from the standpoint of botany and zoology, or plant-biology and animal-biology. The other is the so-called blended or general course, in which animal and plant life are studied as a unit. In such a course general principles of living things and processes are considered in relation to plants and animals, as the occasion may justify. This type of course is favored rather generally by students of education."

Poor Pedagogy of Early Days

A further indication of the status of biology in its early days is found in Reorganization of Science in Secondary Schools.[2] "When biology was

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[1] The Teaching of Science in Texas High Schools, Bulletin #183. Dept. of Ed., Texas, 1924.

[2] Dept. of the Interior, Bureau of Ed., Bulletin, 1920, #26.

introduced into the secondary school, the subject was taught by men and women trained almost wholly in college courses in morphology and classification; and in consequence a diluted type of college course was almost inevitable in the high school. Much of the laboratory material consisted of preserved specimens of plants and animals. Microscopical work of too difficult a type was insisted upon. Herbaria of dried specimens cluttered home and school."

"In recent years increasing emphasis has been placed on the study of living organisms. Physiological experiments and ecological studies have been introduced. But still the type of topic selected for study is more or less that which appeals to the adult mind rather than to the mind of the adolescent. The material used was often remote from the everyday experience of the students, and biological studies still failed to function as largely as had been hoped."

"When teachers began to present biology in its relation to human welfare a new and vital interest in the subject was awakened."

Emphasis on Nature Study

"For some time there has been a distinct trend toward the placing of more emphasis upon nature study in all biological work. For a time the pendulum swung toward the inclusion of 'cutdown' university science subjects in High School Biology, but the pendulum now seems to be swinging back toward the nature study idea. Biology teachers are coming to realize that they are not training their students for college science courses but for living. As a result more emphasis is being placed upon familiarizing them with the elements of their environment."[1]

"It is evident that the New York educational authorities believe that the biology teacher should know something of Natural History. Requirements for a teaching license in biology, which are in force for the first time this year, include a field test for the identification of common plants and animals. Maximum lists of the trees, herbaceous plants, birds, reptiles, amphibians and so on, have been prepared, and the teacher is supposed to be familiar with the forms included on these lists."

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[1] Turtox News, May, 1931, p. 37.

PRESENT CONTENT OF BIOLOGY TEXTS

To get the present trend of content of biology texts in Massachusetts a study of the texts in use was made. A preliminary survey was made through the offices of text-book publishers. A fairly accurate record was compiled this way and although certain schools are shown to use two or more texts the results are not seriously effected. It was found by further examination that certain schools do use more than one text, particularly the larger schools.

Texts Used In Massachusetts

In the number of schools to use them the texts rank as follows:-

49 Hunter, G.W., New Essentials of Biology, Am. Book Co., 1924.

43 Smallwood, W.M., Reveley, Ida L., and Bailey, G. A. New Biology. Allyn and Bacon, 1924.

39 Moon, T. J., Biology for Beginners. Henry Holt & Co. 1929.

27 Peabody, E. J., and Hunt, A. E., Biology and Human Welfare. Macmillan Co., 1924.

5 Gruenberg, B. C., Biology and Human Life. Ginn & Co. 1925.

It will be noted that data has been included on three texts not in common use in Massachusetts. These are: (1) Civic Biology, by Hunter; (2) Living Things, b. Clement; and (3) Introduction to Biology, by Kinsey. All three of these enjoy popularity in neighboring states, the latter two because of the newness, may come into use here.

Analysis of Biology Texts

These texts have been analyzed as to content in an endeavor to get the present trend of content as follows:-

TABLE V

QUANTITATIVE ANALYSIS OF BIOLOGY TEXTS NOW IN USE

Author	pages of Botany	pages of Zoology	pages of Physiology-Hygiene	pages of Biology	Total pages
Clement	288	117	50	95	550
Gruenberg	94	108	256	131	589
Hunter (1)	51	40	137	186	414
Hunter (2)	165	130	116	16	427
Kinsey	46	163	26	276	511
Moon	139	191	139	165	634
Peabody	56	155	101	253	565
Smallwood	180	192	143	150	665
Total	1019	1096	968	1272	4355
Average	127.4	137	121	159	544
%	23.39	25.16	22.2	29.2	

It is evident from this analysis that biology as it is now taught in Massachusetts is about evenly divided between botany, zoology, physiology-hygiene, and "biology".

In other words, the old idea of proportion in biology content (1915) has not changed greatly. However, there is an amount equal to any one of the specialized sciences devoted to strictly "biology" material that illustrates the fundamental relationship of all living things.

Recommendation of Department of Interior

Bulletin #26[1] of the Dept. of the Interior already quoted contains the following recommendation as to what the content of a general biology course should be:-

"The committee believes that a course in biology in the ninth or tenth year should be what the name implies--a study of living things. The central ideas should be:

1. The way in which each organism maintains its own life and the life of the species.

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[1] Reorganization of Science in Secondary Schools, Dept. of the Interior, Bulletin, 1920, #26, p. 31.

2. The interrelations between different organisms and groups of organisms.
3. The constant dependence and interrelations of living things with the physical world about them.
4. The power of man to control the habits and relationships of plants and animals to serve his own ends.

Supplementary Aims in New York State

These recommendations have been supplemented in the New York State Syllabus for Secondary Schools as follows:[1]

1. To give to pupils an intimate knowledge of important living plants and animals and their natural habitats.

2. To present only sufficient knowledge of plant and animal structures to attain the understanding of fundamental functions (since structure is secondary to function) with the purpose of developing wherever possible a knowledge and appreciation of the structural adaptations of plants and animals for particular uses.

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[1] The University of the State of New York, State Department of Education, Syllabus for Secondary Schools, Biology, p. 5.

3. To train the mind of the pupil, by developing his power of accurate observation, perception of the law of cause and effect, and ability to reason to logical conclusions from given data and experimental evidence.

4. To develop an understanding of the relation of biology to the other sciences, to acquire some knowledge of the scientists who have made valuable contributions to biology, and especially to gain an appreciation of the importance of biologic science to civilization.

5. To enrich the life of the pupil (as suggested in the report of the commission), through the esthetic appeal of plants and animals studied, to the end that he may appreciate and enjoy nature.

6. To apply the lessons of physiological specialization, dependence and cooperation to social relationships.

7. To stress the conservation of our natural resources.

8. To emphasize especially the essential conditions of individual and public health in city and State.

9. To give pupils an understanding of the general functions common to the life of all organisms and thus to show the unity of all life.

Because New York State has recognized biology as a secondary school subject since 1905[1] and has had about ten years more of experience to build upon, the subject has been more carefully worked out. This advance has been aided by the New York State Department of Education whose syllabus in biology (1929) contains the following aims:-

1. To give to pupils an intimate knowledge of important living plants and animals and their natural habitats.

2. To present only sufficient knowledge of plant and animal structures to attain the understanding of fundamental functions (since structure is secondary to function) with the purpose of developing wherever possible a knowledge and appreciation of the structural adaptations of plants and animals for particular uses.

3. To train the mind of the pupil, by developing his power of accurate observation, perception of the law of cause and effect, and ability to reason to

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[1] A Study of Laboratory Notebook Work in New York State, by Don O. Baird, p. 2.

logical conclusions from given data and experimental evidence.

4. To develop an understanding of the relation of biology to the other sciences, to acquire some knowledge of the scientists who have made valuable contributions to biology, and especially to gain an appreciation of the importance of biologic science to civilization.

5. To enrich the life of the pupil (as suggested in the report of the commission), through the esthetic appeal of plants and animals studied, to the end that he may appreciate and enjoy nature.

6. To apply the lessons of physiological specialization, dependence and cooperation to social relationships.

7. To stress the conservation of our natural resources.

8. To emphasize especially the essential conditions of individual and public health in city and State.

9. To give pupils an understanding of the general functions common to the life of all organisms and thus to show the unity of all life.

Unfortunately Massachusetts has as yet no such syllabus or statement of aims. However, the analysis of texts common to both states would seem to indicate that the subject is taught here in substantially the same way it is in New York.

Related Factors

Biology in General Science Texts

In an examination of general science texts it is at once apparent that biology is one of the sciences included in that subject. To get an approximation of the amount of biology thus taught a study of nineteen of the commonly used general science texts was made. This was done by counting the number of pages of material on the various topics. There are six branches of science commonly included in general science and a larger number given some attention. These less frequently used topics for convenience were classified as miscellaneous and make up less than ten per cent of the total. Also, some material was found that might fall into two or more classifications. For that reason the names of texts are not associated with their data.

ANALYSIS OF GENERAL SCIENCE TEXTBOOKS

	Astronomy	Biology	Chemistry	Household Arts	Physics	Physiography	Miscellaneous
1.		70	37		410	30	31
2.	28	109	18		182	13	3
3.		355		23	245		31
4.	42	123	19		160	17	77
5.		142	13	56	100	22	30
6.		65	53	32	250	40	31
7.	20	234			228	55	14
8.	8	112	66		206	10	44
9.		10	127		163	16	15
10.	17	152	46	31	237	15	26
11.		20	181				
12.	25	128	42		179	26	34
13.		140		33	175		160
14.	34	134	27	21	259	35	
15.	80	142	10	62	272		36
16.		55	64	36	84		70
17.	20	128			234	125	45
18.	22	167		48	288	23	21
19.		100	24	25	222	20	70
Totals	296	2386	727	367	3894	447	738
Average	15.58	125.58	38.26	193	204.9	23.52	38.8
%	3.34	26.94	8.21	4.14	43.97	5.05	8.33

Subject matter includes print, diagrams, charts, pictures, etc.

TABLE VI

SUMMARY OF ANALYSIS OF GENERAL SCIENCE TEXTS

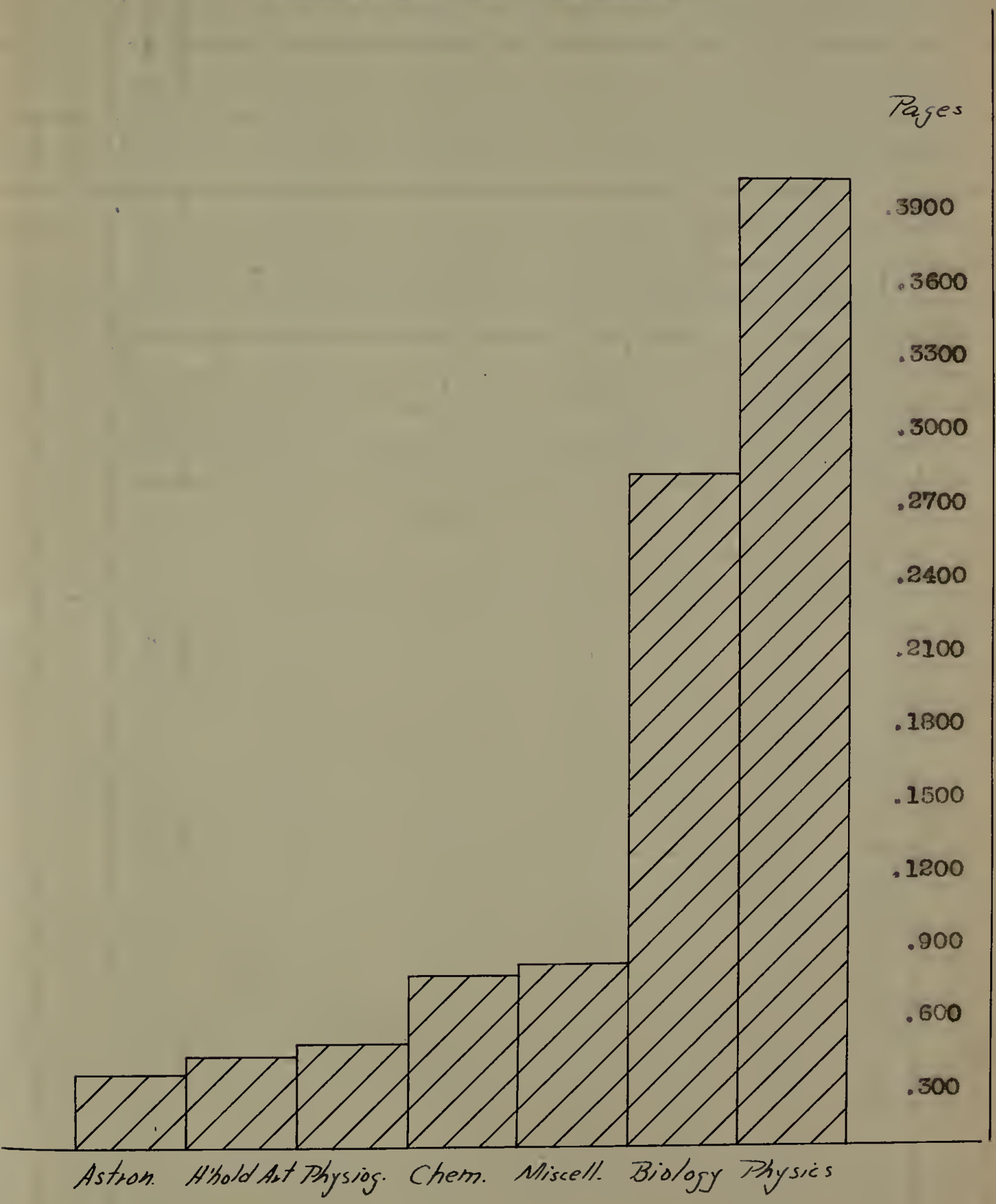
Texts Studied 19

Subject	Pages	%
Physics	3894	43.97
Biology	2386	26.94
Miscellaneous	738	8.33
Chemistry	727	8.21
Physiography	447	5.05
Household Arts	367	4.14
Astronomy	296	3.34

TABLE VII
GENERAL SCIENCE TEXTS STUDIED

Author	Text	Publisher	Year
Barber and others	First Course in Gen. Sc.	Henry Holt and Co.	1917
Bedford	General Science	Allyn and Bacon	1921
Bowden	General Science	Blakiston	1923
Caldwell & Eikenberry	General Science	Ginn and Company	1918
Caldwell & Meier	Open Doors to Science	Ginn and Company	1926
Clark	An Introduction to Sc.	American Book Co.	1915
Clement-Collister-Thurston	Our Surroundings	Iroquois Publishing Co.	1928
Elhuff	General Science	D. C. Heath and Co.	1916
Fall	Science for Beginners	World Book Company	1917
Hessler	Junior Science	Benjamin H.Sanborn & Co.	1920
Holmyard	General Sience	E.P. Dutton and Co.	1927
Hunter & Whitman	Civic Science in H.& C.	American Book Company	1923
Lake	General Science	Silver Burdett & Co.	1917
Pieper and Beauchamp	Everyday Problems	Scott, Foresman & Co.	1925
Rogenstein-Teeters	General Science	Rand, McNally & Co.	1928
Rush andWinslow	The Science of Things About Us	Little Brown and Co.	1919
Snyder	Everydny Science	Allyn and Bacon	1919
Trafton	Science of Home and Community	Macmillan	1926
Vanbuskirk & Smith	The Science of Everyday Life	Houghton Mifflin Co.	1925

Graphic Representation of Material Given in Nineteen Gen. Scó. Textbooks



From an examination of the data upon Biology in General Science texts it is seen that each text includes some biology material. The amount varied all the way from ten pages to three hundred fifty-five with the average at one hundred twenty-five or in the neighborhood of twenty-seven percent. This is taken as a fair indication of the importance general science textbook writers attach to biology. The average per cent of biology included is exceeded only by that of physics (about forty-four per cent).

Recognition of Biology as a Subject for College Entrance Credit

Recognition by College Entrance Board

"The College Entrance Board of the Middle States and Maryland was organized on November 17, 1900, and the first examination was given in June, 1901. Natural science subjects were not offered in 1901. Botany was the first natural science subject given, being a part of the examination in 1902. Zoology was added in 1907, but the first examination in biology was not offered until 1914.

"The pupil has always had a choice of questions in the natural sciences. Beginning in 1914 the questions for each subject were grouped and a still wider range of choice of questions was permitted. The early questions were mostly of the fact or memory question type. The emphasis was on structure in plants and animals until 1914, when the idea of thought-provoking questions began to dominate, and much less emphasis was placed on structure. The emphasis changed from structure to the functional behavior of plants and animals, and at the present time there is a tendency to stress the health and economic phases in the

biology examinations. The work of drawings has been emphasized from the beginning, but in the biology examinations offered during the past three years it has been possible for pupils to make a good grade without any drawings at all.

"Much credit has been allowed for notebook work in the past. In the first natural science examination--botany in 1902--64 counts were given for examination questions and 36 counts for the laboratory notebook. This proportion for the natural sciences remained about the same until 1911, when a teacher's certificate covering the laboratory instruction was substituted for the submission of a notebook. From 1911 to the present time it appears that the notebook is not counted in arriving at the pupil's College Entrance examination grade, but that the teacher's certificate is required as a part of and a prerequisite to the examination in natural sciences.

"Beginning with 1917, health questions appear more frequently in the natural science examinations, and the economic phase receives considerably more attention. Since 1926 there has been a change, in part, to the newer type of questions, such as the true-false, completion, multiple-choice, etc."

Definition of the Requirements

"The College Entrance Examination Board's "Definition of the Requirements" for 1929 specify that the minimum requirements in biology are: "Course I--a year of biology with emphasis on the applications of biology to human welfare" or "Course II--a year of biology with emphasis on the structure and function of plant and animals." The examination questions cover" (1) the structure of plants and animals. (2) the physiology, life history, and classification of plants and animals. (3) The applications of biology to human welfare." The College Entrance Examination Board also specifies in detail just what should be studied in Courses I and II. Course II represents the older type of work and this is the course that most of the pupils who submitted notebooks for this investigation must have pursued."

Recognition at the New England Colleges

Inasmuch as this study is concerned primarily with the status of biology in Massachusetts it has been ascertained just when biology became recognized as an acceptable subject for college entrance at the

New England colleges. It is assumed that the great majority of Massachusetts pupils preparing for college will enter one of these institutions. The data for this phase of the study was obtained by a letter to each of the institutions. As indicated in the accompanying table biology has been accepted by every college and university in New England since 1922.

TABLE VIII

BIOLOGY ACCEPTED FOR COLLEGE ENTRANCE CREDIT

College	Year
Albertus Magnus	1925
Amherst	1907
Bates	circa 1922
Boston College	always
Boston University	at lest since 1916
Brown	1920
Clark	1902
Colby	1908
Connecticut Agricultural	always
Connecticut College for Women	always
Dartmouth	C.E.E.B. 1914
Emmanuel	1919
Harvard	1918
International Y.M.C.A.	always
Lowell Textile	(not in catalogue) yes
Maine	1906
Massachusetts	1921
M.I.T.	always
Middlebury	(date uncertain) yes
Mount Holyoke	1912
University of New Hampshire	circa 1910
Northeastern	(date uncertain) yes
Providence	always
Radcliffe	1916
Rhode Island	(date uncertain) yes
St. Anselm's	1917
St. Michael's	always
Simmons	1912
Smith	C.E.E.B. 1914
Trinity	1921
Tufts	circa 1900
Vermont	circa 1900
Wesleyan	1911
Williams	1907
W.P.I.	1906
Wellesley	C.E.E.B 1914
Wheaton	1919
Yale	1915

Summary of Findings

This study has determined the significant changes in the development of the unified subject of biology from the specialized biological subjects to its present position in the public secondary schools of Massachusetts. The findings are here given in the order in which they occur in the body of the study:

1. The old specialized sciences of astronomy, botany, geology, physics, physical geography, and physiology have all fallen off in point of pupil enrollment since 1900 (p.24.) The one exception to this decline is chemistry. This loss has been more than compensated for by the increase in enrollment in general science and general biology since 1915.

2. Although physiology was one of the first of the old line subjects to suffer a decline in enrollment it is now holding its own and is in a stronger position in Massachusetts than any other biological subject except "biology" itself. (Table IV) The reason ascribed to this is the state law requiring instruction in this subject.

3. Faulty aims and unsound pedagogical principles that were attached to the older biological subjects were the primary causes of their abandonment. Two of these that were prevalent about 1900 were (1) a religious aim of natural science, and (2) a scientific attitude of mind ascribed to the study of science.

4. There is a marked tendency to teach biology in the tenth

year of the high school except in the smaller high schools where it often alternates with general science to combined classes of fresh-men and sophomores. (p. 32).

5. There is a very strong tendency for biology to be taught five periods (p. 35), and contrary to the recommendations of the Department of the Interior it is not followed by an intensive course in one of the specialized sciences.

6. Biology as it is now taught in Massachusetts is about evenly divided between botany, zoology, physiology-hygiene, and "biology". There is a marked tendency to integrate these into a "synthetic" course to illustrate the fundamental relationship of all living things. (p. 46).

7. The purpose of biology has taken on a practical aspect in relation to human welfare. The central ideas involved are to teach (1) the way in which each organism maintains its own life and the life of the species, (2) the interrelations between different organisms and groups of organisms, (3) the constant dependence and interrelations of living things with the physical world about them, and (4) the power of man to control the habits and relationships of plants and animals to serve his own ends. (p. 47).

8. More than one quarter of the content of general science texts is biological material. This average is exceeded only by that of physics (about forty-four per cent.) (p. 57).

9. Biology is now accepted at all colleges and universities in New England for entrance credit. Recognition was first ac-

corded in 1900 by a few institutions and the other followed slowly. The college Entrance Examination Board supplied the impetus for its general acceptance by offering an examination in the biology in 1914. Since the year 1922 biology has been recognized and entrance credit allowed for it by every collegiate institution in New England.

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Heselon	Junior Science, Benjamin H. Sanborn & Co., 1920.
Hodge, C. F., and Dawson, J.	Civic Biology. Ginn and Co., 1918.
Holmyard,	General Science, E. P. Dutton and Co., 1927.
Hunter, G. W.	A Civic Biology. American Book Co., 1914.
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Data from the Massachusetts State Department of Education biennial reports upon which have beeh based Tables III and IV and Figures II, III, and IV.

Legend:

"#Year" indicates the year biology is offered in each school, i.e. (1) = the freshman year or the ninth grade, etc.

"##Periods" indicates the number of periods biology is taught each week through a full school year. A period is approximately forty-five minutes.

"###P-H" indicates physiology and hygiene, either or both.

Biology in Massachusetts Public High Schools.

1924 - 1925

Town	Year#	Periods##	Biology	Botany	Zoology	P-H###
Abington	2	5	36			36
Acton						
Adams	2,3	7	76			
Agawam	2	4	10			
Amesbury	2	5	61			
Amherst	2	5	65			
Andover				22	19	
Arlington	2,3,4	5	71			
Ashby	1,2	5	8			
Ashfield	1,2	5	21			
Ashland	2	5	16			
Athol	2	5	24			
Attleboro	2	5	40			
Avon						
Ayer	2	5	10			
Barnstable	1	4	34			
Barre						
Belchertown	2	5	31			
Belmont	2,3,4	5	97			
Bernarston	1,2	5	16			
Everly	2	3	62			
Ellerica						
Backstone						
Bourne	1	5	71			
Braintree	2	5	27			

Biology in Massachusetts Public High Schools (Cont'd.)

1924 - 1925

Town	Year	Periods	Biology	Botany	Zoology	P-H
Brewster						
Bridgewater	2	4	61	61		
Brimfield						
Brockton						
Brookfield						
Brookline	2	4	118			
Cambridge:						
High & Latin						
Rindge						
Canton	2	5	25			
Charlemont	2	5	13			
Charleton	1,2	5	34			
Chatham	2,3,4	5	16			
Chelmsford	2	5	24			
Chelsea	2	5	98			
Chester						
Chicopee				132		
Clinton						
Cohasset	2	4	11			
Concord				18		18
Dalton	2	5	31			
Danvers	2	5	51			
Dartmouth	2	5	17			
Dedham	4	4				8
Deerfield	2	5	6			
Dennis	1,2	5	21			
Douglas						

Biology in Massachusetts Public High Schools (Cont'd.)

1924 - 1925

Town	Year	Periods	Biology	Botany	Zoology	P-H
Dover						
Duxbury	2	5	11			
E. Bridgewater	2	5	30			
Easthampton						
Easton	2	4	66			
Edgartown						
Essex						
Everett	4	5	49	47		
Fairhaven				45		
Fall River	2,3	5	316	52	21	
Falmouth						
Fitchburg	3,4	4	108			
Foxboro						
Framingham	2	5	125			
Franklin	2	5	40			
Gardner	2,3,4	5	56			56
Gloucester	2,3	5	108			
Grafton	2,3	7	18			
G. Barrington	2	5	59			
Greenfield	2	5	8			
Groton	2	5	29			
Groveland	2	5	21			
Hadley						
Hamilton	2,3,4	5	10			
Hanover						

Biology in Massachusetts Public High Schools (Cont'd.)

1924 - 1925

Town	Year	Periods	Biology	Botany	Zoology	P-H
Hardwick	2	7	16			
Harwich	1	5	16			
Hatfield	1,2	5	26			
Haverhill	2,3	5	230			
Hingham	2	5	64			
Holbrook						
Holden						
Holliston						
Holyoke				95		
Hopedale				28	28	
Hopkinton	2,3	5	22			
Hudson						24
Huntington	2	5	15			
Ipswich						
Kingston						
Lancaster						
Lawrence				112		
Lee						
Leicester	2	5	27			
Lenox						
Leominster	2	5	95			
Lexington	2	5	63			
littleton						
Lowell				87		288
Ludlow	2	5	12			

Biology in Massachusetts Public High Schools (Cont'd.)

1924 - 1925

Town	Year	Periods	Biology	Botany	Zoology	P-H
Lunenburg	1,2	5	23			
Lynn:-						
Classical	3	5	40			
English				80	41	
Malden	4	5	24	19		19
Manchester	2	5	36			
Mansfield	2	5	41			
Marblehead						
Marlboro						
Marshfield		5	8			
Maynard	1	5	43			
Medfield	2	5	15			
Medford	2	5	106			
Medway						
Melrose	4	5	65			
Mendon						
Merrimack						
Methuen	2	5	78			
Middleboro						
Milford						
Millbury	2	5	25			
Millis	3,4	5	14			
Milton	2	5	50			25
Monson	2	5	21			
Montague	1,2	5	49			

Biology in Massachusetts Public High Schools (Cont'd.)

1924 - 1925

Town	Year	Periods	Biology	Botany	Zoology	P-H
Nantucket	4	4	6			
Natick	2	5	18			
Needham						
New Bedford	2	5	61			34
Newburyport						
New Marlboro						
New Salem	2	5	5	5		
Newton	2,3	5	406	115	31	185
N. Adams	2	5	89	57		
Northampton	2	4	47			
N. Andover						
N. Attleboro	2	5	29			
Northboro						
Northbridge	2	5	47			
N. Brookfield	3	5	23			
Northfield						
Norton						
Norwell						
Norwood	2	5	62			
Oak Bluffs						
Orange	2	4	67			
Orleans	2	5	12			
Oxford	2	5	20			
Palmer	2	5	23			
Peabody	3	5	27			

Biology in Massachusetts Public High Schools (Cont'd.)

1924 - 1925

Town	Year	Periods	Biology	Botany	Zoology	P-H
Pembroke						
Pepperell		5	30			
Petersham	1,2	5	8			
Pittsfield	2	5	97			
Plainville						
Plymouth	2	5	89			
Princeton						
Provincetown	2,3,4	5	41			
Quincy	2	5	134			
Randolph	2,3,4	5	14			
Reading	1	5	84			
Revere	2	5	121			
Rockland	2	5	124			
Rockport						
Rutland	2	4	8			
Salem						24
Sandwich	2	4	12			
Saugus						12
Scituate	2	5	18			
Sharon						
Sheffield						
Shelburne	2	6	25			
Sherborne	2,3,4	5	13			
Shrewsbury						
Somerset	2	5	33			

Biology in Massachusetts Public High Schools (Cont'd.)

1924 - 1925

Town	Year	Periods	Biology	Botany	Zoology	P-H
Somerville	2,4	5	212			28
Southbridge	2	5	5			
Southboro	1	5	31			
S. Hadley	2	5	22			
Spencer	3,4	5	24			
Springfield:						
Central	2,4	5	96			45
Commerce						
Technical						
Stockbridge	1	5	22			
Stoneham						
Stoughton	2	5	20			
Sudbury	1,2	4	24			
Sutton	1,2	5	40			
Swampscot	2	5	62			
Swansea						
Taunton	2	5	104			
Templeton	2	5	29			
Tisbury	1,2	5	38			
Topsfield						
Townsend						
Upton	1,4	5	38			
Uxbridge						
Wakefield	2	5	31			

Biology in Massachusetts Public High Schools (Cont'd.)

1924 - 1925

Town	Year	Periods	Biology	Botany	Zoology	P-H
Walpole	2	5	39			
Waltham				21		14
Ware	2	5	25			
Wareham	2	5	32			
Warren						
Watertown	2	4	49			
Wayland						
Webster	3	5	51			
Wellesley	2	5	28			
Wellfleet						
Westboro	2	5	25			
W. Boylston	1,2	5	17			
W. Bridgewater	2	5	22			
Westfield	1	9	38			
Westford	2	4	27			
W. Newbury						
Weston	2	4	17			
Westport						
W. Springfield		5	130			
Weymouth						
Whitman						
Williamsburg						
Williamstown	2	5	20			
Wilmington	2	5	18			
Winchendon	2	5	43			

Biology in Massachusetts Public High Schools (Cont'd.)

1924 - 1925

Town	Year	Periods	Biology	Botany	Zoology	P-H
Winchester	2	5	28			
Winthrop	2	5	11			
Woburn						114
Worcester:						
Commerce				170	33	341
Classical	1,4	5	125			
North				88	34	122
South				119	45	314
Wrentham	2	8	16			
Yarmouth	2	4	11			

Biology in Massachusetts Public High Schools.

1926 - 1927

Town	Year #	Periods##	Biology	Botany	Zoology	P-H###
Abington	2	5	32			76
Acton	2		?			?
Adams	2	7	50			
Agawam	2	4	27			
Amesbury	2	5	117			
Amherst	2	5	47			
Andover				20	20	
Arlington	2		110			
Ashby	1,2	5	23			
Ashfield	1,2	5	22			
Ashland	2	5	21			
Athol	2	5	29			
Attleboro	2	5	49			30
Avon						
Ayer						
Barnstable	2	5	38			
Barre						
Belchertown	2	5	16			
Belmont	2,3	5				86
Bernardston	1,2	5	24			
Beverly	2,	3	89			79
Billerica						
Blackstone						
Bourne	1	5	41			
Braintree	2	5	48			

Biology in Massachusetts Public High Schools (Cont'd.)

1926 - 1927

Town	Year	Periods	Biology	Botany	Zoology	P-H
Brewster						
Bridgewater	2	4	45	45		
Brimfield	2	5	12			
Brockton	1,2	5	94			81
Brookfield						
Brookline	2,4	4	117			
Cambridge:-						
High & Latin						
Rindge						
Canton	2	5	29			
Charlemont	2,3,4	5	12			
Charleton	1,2	5	36			
Chatham	2	4	21			
Chelmsford	2	5	32			
Chelsea	2	5	137	[illegible]		
Chester	1,2	5	?			
Chicopee				14		
Clinton						
Cohasset						
Concord				17		
Cummington	1,2	5	16			
Dalton	2	5	36			
Danvers	2	5	49			
Dartmouth	2	5	30			
Dedham	2	4	89			19

Biology in Massachusetts Public High Schools (Cont'd.)

1926 - 1927

Town	Year	Periods	Biology	Botany	Zoology	P-H
Deerfield	2	5	21			
Dennis						
Douglas						
Dover						
Duxbury	2	5	22			
E. Bridgewater	2	5	36			
Easthampton						
Easton	2	4	32			
Edgartown						
Essex	2,3,4	5	14			
Everett	3,4	5	241	51		
Fairhaven	2,3	5	53			36
Fall River	2,3,4	5	336			108
Falmouth						210
Fitchburg	2,3,4	5	275			
Foxboro						
Framingham	2	5	95	9		
Franklin	2	5	40			
Gardner	2	5	60			60
Gloucester	2	5	132			
Grafton	2,3	7	4			
G. Barrington	1,2	7	100			
Greenfield	2	6	38			
Groton	2	5	38			
Groveland	2	5	27			

Biology in Massachusetts Public High Schools (Cont'd.)

1926 - 1927

Town	Year	Periods	Biology	Botany	Zoology	P-H
Hadley	2	5	17			
Hamilton						37
Hanover						15
Hardwick	2	5	12			
Harwich						
Hatfield	1,2	?				11
Haverhill		5	218			
Hingham	2	5	58			
Holbrook						
Holden	2	5	29			
Holliston						
Holyoke				105		
Hopedale	2	6	19			
Hopkinton	2	5	24			
Hudson				14		14
Huntington	2	5	22			
Ipswich						
Kingston	2	5	6			
Lancaster						
Lawrence	3	5	?			?
Lee						42
Leicester	2	5	6			
Lenox						
Leominster	2	5	95			
Lexington	2	5	54			

Biology in Massachusetts Public High Schools (Cont'd.)

1926 - 1927

Town	Year	Periods	Biology	Botany	Zoology	P-H
Littleton						
Lowell				77		155
Ludlow	2	5	7			
Lunonburg	2	5	9			
Lynn:-						
Classical	3	5	73			
English				146	64	
Malden	4	5	35			36
Manchester	2	5	40			
Mansfield	2	3	17			
Marblehead	2	5	53			
Marleboro						
Marshfield	1,2	5	14			
Maynard			82			
Medfield	2	5	21			
Medford	2	5	111			
Medway	1	5	24			
Melrose	3,4	5	114			
Mendon						
Merrimack						
Methuen	2	5	83			
Middleboro						
Milford						
Milbury	2	5	16			
Millis						

Biology in Massachusetts Public High Schools (Cont'd.)

1926 1927

Town	Year	Periods	Biology	Botany	Zoology	P-H
Milton	1	5	92			20
Monson	2	5	20			
Montague	1	5	36			
Nantucket	2	4	26			
Natick	2	5	45			
Needham						
New Bedford	2	5	89			53
Newburyport						
New Marlboro	2	4	8			
New Salem	2	5	?			
Newton	2	5	188	103		258
N. Adams	2	5	101			
Northampton	2	4	65			
N. Andover						
N. Attleboro	2	5	16			
Northbridge	2	5	16			
N. Brookfield	2	5	28			
Northfield	2	5	15			
Norton						
Norwell						
Norwood	2	5	139			
Oak Bluffs	3	5	2			
Orange	2	4	60			
Orleans	2	5	13			

Biology in Massachusetts Public High Schools (Cont'd.)

1926 - 1927

Town	Year	Periods	Biology	Botany	Zoology	P-H
Oxford	2	5	21			
Palmer	2	5	?			
Peabody						22
Pembroke	3,4	5	5			
Pepperell	2	5	38			
Petersham						
Pittsfield	2	5	106			
Plainville						
Plymouth	4	5	101			
Princeton						?
Provincetown	2	5	58			
Quincy	2	5	186			
Randolph	2	5	46			
Reading	1	5	72			157
Revere	2	5	212			
Rockland	2	5	25			42
Rockport						
Rutland						
Salem						16
Sandwich	2	4	16			
Saugus						
Scituate	2	5	14			
Sharon	2	5	25			
Sheffield	2	4	7			
Shelburne	2	7	27			3
Sherborne	1,2	5	15			

Biology in Massachusetts Public High Schools (Cont'd.)

1926 - 1927

Town	Year	Periods	Biology	Botany	Zoology	P-H
Shrewsbury	2	5	33			
Somerset	2	5	17			
Somerville	2,4	5	340			42
Southboro	1	5	15			
Southbridge	2	5	6			
S. Hadley	2	5	28			
Spencer	2,3	5	25			
Springfield:						
Central	2,4	5	113			76
Commerce						?
Technical				43		43
Stockbridge	1	5	38			
Stoneham	4,5	3	76			
Stoughton	2	5	16			
Stow						
Sudbury	1,2	3	23			
Sutton	1	5	19			
Swampscott	2	5	58			
Swansea						
Taunton	2	5	186			
Templeton		5	41			
Tisbury	1,2	5	30			
Topsfield	2	5	9			
Townsend	1	5	39			
Upton	1,2	5	35			

Biology in Massachusetts Public High Schools (Cont'd.)

1926 - 1927

Town	Year	Periods	Biology	Botany	Zoology	P-H
Uxbridge						
Wakefield	2	5	15			
Walpole	2	5	22			
Waltham	2	5	158			
Ware	2		?			
Wareham	2	5	28			
Warren						
Watertown	2	4	55			
Wayland						
Webster	3	5	44			
Wellesley	2	5	50			
Wellfleet						
Westboro	2	5	29			
W. Boylston	2	5	15			
W. Bridgewater	2	5	12			
Westfield	1,2	9	40			
Westford	2	4	22			
W. Newbury						
Weston	2	4	14			
Westport						
W. Springfield	2	5	96			
Weymouth						4
Whitman						
Williamsburg						
Williamstown	2	5	11			

Biology in Massachusetts Public High Schools (Cont'd.)

1926 - 1927

Town	Year	Periods	Biology	Botany	Zoology	P-H
Wilmington	2	6	21			
Winchendon	2	5	28			
Winchester	2	5	38			
Winthrop						
Woburn						103
Worcester:-						
Classical	1	5	132	64		
Commercial				254	75	338
North				59	83	137
South				95	37	291
Wrentham	2	5	13			
Yarmouth	2	4	18			

Biology in Massachusetts Public High Schools

1928 - 1929

Town	Year #	Periods##	Biology	Botany	Zoology	P-H##
Abington	2	5	30			
Acton						
Adams	1	7	58			
Agawam	1,2	4	48			
Amesbury	2	5	104			
Amherst	2	5	50			
Andover				25	25	
Arlington	2	5	87			
Ashby						
Ashfield	1,2	5	32			
Ashland	2	5	20			
Athol	2	5	62			
Attleboro	2	5	30			23
Avon						
Ayer	2	3	11			
Barnstable	2	5	19			
Barre						
Belchertown	2	5	22			
Belmont	2,3	5	130			
Bernardston	1,2	5	16			
Beverly	2	5	43			96
Billerica						
Blackstone						
Bourne	1	5	48			
Braintree	2	5	65			

Biology in Massachusetts Public High Schools (Cont'd.)

1928 - 1929

Town	Year	Periods	Biology	Botany	Zoology	P-H
Brewster						
Bridgewater	2	4	47			
Brimfield	2	5	11			
Brockton				77	77	128
Brookfield						
Brookline	2	4	161			
Cambridge:						
High& Latin						
Rindge						
Canton	2,3	5	28			
Charlemont	2,3	5	14			
Charleton	2,3	5	9			
Chatham	2,4	4	16			
Chelmsford	2	5	43			
Chelsea	2	5	178			
Chester	1,2	5				
Chicopee				48		
Clinton						48
Cohasset	2	4	23			
Concord	3,4			19		19
Cummington	1,2	5	8			
Dalton	2	5	27			
Danvers	2		52			
Dartmouth	2	10	14			
Dedham	2	4	67			17

Biology in Massachusetts Public High Schools (Cont'd.)

1928- 1929

Town	Year	Periods	Biology	Botany	Zoology	P-H
Deerfield	2	5	44			
Dennis						
Douglas						
Dover						
Duxbury	2	5	9			
East B'water	2	5	45			
Easthampton	1	5	70			
Easton	2	4	48			
Edgartown						
Essex	2,3,4	5	10			
Everett	2	5	196			
Fairhaven	2,3		75			34
Fall River	2,3,4	5	165			
Falmouth						
Fitchburg	2,3	5	305			
Foxboro	2	6	28			
Framingham	2,3	5	155	42		
Franklin	2	5	39			
Gardner						80
Gloucester	2	5	186			
Grafton	2	5	23			
G. Barrington	1,2	7	93			
Greenfield	2	6	95			
Groton	2	5	31			
Groveland	2	5	23			

Biology in Massachusetts Public High Schools (Cont'd.)

1928 - 1929

Town	Year	Periods	Biology	Botany	Zoology	P-H
Hadley	2	5	27			
Hamilton	2	2	34			
Hanover	2	5	16			
Hardwick	2	5	19			
Harwich	1,2	5	9	9		
Hatfield	1,2	5	7			
Haverhill	2	5	258			
Hingham	1,2	4	42			
Holbrook	2	5	17			
Holden	2	5	35			37
Holliston						
Holyoke				68		
Hopedale	2	6	22			
Hophinton	2	5	26			
Hudson	2	5		10		10
Huntington	2	5	21			
Ipswich						
Kingston	2	5	9			
Lancaster						
Lawrence	3,4	5	257	235		105
Lee	1					66
Leicester	2	5	24			
Lenox						
Leominster	2	5	81			
Lexington	4	5	109			

Biology in Massachusetts Public High Schools (Cont'd.)

1928 - 1929

Town	Year	Periods	Biology	Botany	Zoology	P-H
Littleton	1,4	5				
Lowell	3	5	111			42
Ludlow	2	5	16			
Lunenburg	2	5	13			
Lynn:-						
Classical	3	5	133			
English				206	76	
Malden	4	5	58			
Manchester	2	5	16			
Mansfield						
Marblehead	2	5	44			
Marleboro	2	6	22			
Marshfield	1,2	5	31			
Maynard	2	5	71			
Medfield	2	5	25			
Medford	2	5	167			
Medway	1	5	28			
Melrose	3,4	5	121			
Mendon						
Merrimac						
Methuen	2	5	125			
Middleboro						
Milford						
Millis						

Biology In Massachusetts Public High Schools (Cont'd.)

1928 - 1929

Town	Year	Periods	Biology	Botany	Zoology	P-H
Milton	2	5	75			27
Monson	2	5	15			
Montague	1,2	5	38			
Nantucket	2	5	25			
Natick	2,3	5	49			
Needham						
New Bedford	2	5	194			75
Newburyport						
New Marleboro						
New Salem	2	5	14			
Newton	2	4	240	122		64
N. Adams	2	5	114			27
Northampton	2	4	113			
N. Andover						
N. Attleboro	1	5	30			
Northboro						
Northbridge	2	5	57			
N. Brookfield	2	5	23			
Northfield	2	5	19			
Norton						
Norwell						
Norwood	2	5	152			
Oak Bluffs						
Orange	2	4	43			
Orleans	2	5	12			

Biology in Massachusetts Public High Schools (Cont'd.)

1928 - 1929

Town	Year	Periods	Biology	Botany	Zoology	P-H
Oxford	2	5	22			
Palmer	2	5	37			
Peabody						18
Pembroke	2	5	8			
Pepperell	2	5	15			
Petersham						
Pittsfield	2	5	115			60
Plainville						
Plymouth	2	5	88			
Princeton	3	5	20			9
Provincetown	2	5	51			
Quincy	2	5	232			
Randolph	2	7	18			
Reading	2	6	25			
Revere	2	5	241			
Rockland	2	5	20			
Rockport	1	1				30
Rutland	2	5	16			
Salem						9
Sandwich						
Saugus	2,3,4	5	33			
Scituate	2	5	36			
Sharon	2		22			
Sheffield	2	5	14			
Shelbourne	2	7	26			

Biology in Massachusetts Public High Schools (Cont'd.)

1928 - 1929

Town	Year	Periods	Biology	Botany	Zoology	P-H
Sherbourn	1,2	4	21			
Shrewsbury						
Somerset	2	5	24			
Somerville	2,4	5	421			57
Southboro						
Southbridge	2	5	15			
S. Hadley	2	5	48			
Spencer	2	5		33	33	
Springfield:-						
Central	2,4	5	155			77
Commerce						
Technical				120		80
Stockbridge	1	5	26			
Stoneham	2,4	4	39			
Stoughton	2	5	52			
Stow						
Sudbury	1,2	5	5			
Sutton	2,3,4	5	18			
Swampscott	2	5	70			
Swansea	2	5	15			
Taunton	1,4	5	207			
Templeton	2	5	8			
Tisbury	1,2	5	34			
Topsfield	2	5	4			
Townsend	1	5	26			

Biology in Massachusetts Public High Schools (Cont'd.)

1928 - 1929

Town	Year	Periods	Biology	Botany	Zoology	P-H
Upton	1,2	5	27			
Uxbridge						
Wakefield	2	5	45			
Walpole	2	5	30			
Waltham	2	5	170			
Ware	2	5	45			
Wareham	2	5	24			
Warren	2,3,4	5	28			
Watertown	2	4	55			12
Wayland						
Webster	2	5	78			
Wellesley	1	5	50			
Wellfleet	1	5	15			
Westboro	2	5	39			
W. Boylston	2	5	9			
W. Bridgewater	2	5	9			
Westfield				19	19	
Westford	2	5	23			
W. Newbury						
Weston	2	5	15			
Westport						
W. Springfield	2	5	136			
Weymouth						38
Whitman						
Williamsburg	2,3	5		11	11	
Williamstown	2	5	28			128

Biology in Massachusetts Public High Schools (Cont'd.)

1928 - 1929

Town	Year	Periods	Biology	Botany	Zoology	P-H
Wilmington	2	5	27			
Winchendon	2	5	19			
Winchester	2	5	60			
Winthrop	2	5	34			
Woburn						87
Worcester:-						
Commerce				287	55	389
Classical	1	5	109	68		
North				68	66	151
South				83	45	259
Wrentham	2	5	10			
Yarmouth	2	4	12			

Biology in Massachusetts Public High Schools

1930 - 1931

Town	Year#	Periods##	Biology	Botany	Zoology	P-H ###
Abington	2	5	26			65
Acton	2	5				
Adams						
Agawam						
Amesbury	2	5	110			
Amherst	2	5	79			
Andover				31	31	
Arlington	2	5	100			46
Ashby	1	5	20			
Ashfield	1,2	5	?			
Ashland	2	5	24			
Athol	2	5	49			
Attleboro	2	5	89			
Avon						
Ayer						
Barnstable	2	4	53			150
Barre						
Belchertown	2	6	29			
Belmont	2,3	5	105			
Bernardston	2	5	16			
Beverly	2	5	184			
Billerica						
Blackstone						
Bourne	1	5	41			
Braintree	2	5	71			

Biology in Massachusetts Public High Schools (Cont'd.)

1930 - 1931

Town	Year	Periods	Biology	Botany	Zoology	P-H
Brewster						
Bridgewater	2	4	?			
Brimfield	2	5	14			
Brockton	1,4	5		111	111	66
Brookfield						
Brookline						
Cambridge						
Canton	2,3	5	32			
Charlemont						
Charleton						
Chatham	2	5	18			
Chelmsford	2	5	22			
Chelsea	2	5	189			
Chicopee	2	5	168	14		
Clinton	2	5	90			75
Cohasset						
Concord				31		31
Cummington						
Dalton	2	5	28			56
Danvers	2	5	70			
Dartmouth	2	7	25			
Dedham	2	4	92			23
Deerfield	2	5	37			
Dennis	3,4	5	18			
Douglas						

Biology in Massachusetts Public High Schools (Cont'd.)

1930 - 1931

Town	Year	Periods	Biology	Botany	Zoology	P-H
Dover						
Duxbury	2,3	5	25			
E. Bridgewater	2	5	46			
Easthampton						
Easton	2	4	54			
Edgartown						
Essex	2	5	19			
Everett	2	5	167			
Fairhaven	2,3	5	57			42
Fall River	2,3,4	5	120			908
Falmouth	2	5	51			
Fitchburg	2,3,4	5	508			
Foxboro	2,4	5	21			
Framingham	2	5	187			
Franklin	2	5	56			
Gardner	2	5	100			
Glouster						
Grafton	2	5	19			
Great B'ngtn	1,2	5	114			
Greenfield						
Groton	2	5	24			
Groveland	2	5	23			
Hadley						
Hamilton						
Hanover						

Biology in Massachusetts Public High Schools (Cont'd.)

1930 - 1931

Town	Year	Periods	Biology	Botany	Zoology	P&H
Hardwick	2	5	25			
Harwich						
Hatfield	1,2	5	25			
Haverhill			297			43
Hingham	2	4	23			
Holbrook						
Holden	2	5	31			
Holliston						
Holyoke						
Hopedale	2	6	20			
Hopkinton	2	5	26			
Hudson						19
Huntington	2	5	27			
Ipswich						
Kingston						
Lancaster						
Lawrence	3,4	5	341			181
Lee	2	6	16			
Leicester	2	5	42			
Lenox						
Leominster	2	5	80			
Lexington	2	5	141			
Littleton						
Lowell	3	5	206			
Ludlow	2	5	58			

Biology in Massachusetts Public High Schools (Cont'd.)

1930 - 1931

Town	Year	Periods	Biology	Botany	Zoology	P-H
Lunenburg						
Lynn :-						
Classical	3	5	99			
English				186	134	20
Malden	4	5	71			
Manchester	2	5	19			
Mansfield						
Marblehead	2	5	55			
Marleboro						
Marshfield	1,2	5	28			
Maynard	2	5	114			
Medfield	2	5	30			
Medford	2	5	227			490
Medway	1	5	34			
Melrose	3,4	5	138			
Mendon						
Merrimack	1	5	30			
Methuen	2	5	126			
Middleboro						
Milford						
Millbury		5	40			
Millis	3,4	5	19			
Milton	2	5	96			
Monson	2	5	11			
Montague	2	5	40			
Nantucket	2	4	34			

Biology in Massachusetts Public High Schools (Cont'd.)

1930 - 1931

Town	Year	Periods	Biology	Botany	Zoology	P-H
Natick	2	5	144			
Needham	2,3	5	96			
New Bedford	2	5	181			66
Newburyport						
New Marlboro	2	6	9			
New Salem	1,2	5	21			
Newton	2	4	260	175		137
N. Adams	2	5	139			23
Northampton	2	4	121			
N. Attleboro	2	4	56			
N.Andover	2	5	39			
Northboro						
Northbridge	2	5	72			
N. Brookfield	2	5	19			
Northfield	2	5	?			
Norton						
Norwell						
Norwood	2	5	135			
Oak Bluffs						
Orange	2	4	61			
Orleans	2,3	5	19			
Oxford						
Palmer	2	5	87			
Peabody						25
Pembroke	1,2,3,4	5	21			

Biology in Massachusetts Public High Schools (Cont'd.)

1930 - 1931

Town	Year	Periods	Biology	Botany	Zoology	P-H
Pepperell	2	5	26			
Petersham						
Pittsfield	2	5	200			
Plainville						
Plymouth	2	5	134			
Princeton	2	5	?			
Provincetown	2	5	38			
Quincy	2	5	363			
Randolph						
Reading	2	6	80			
Revere	2	5	265			
Rockland	2	5	27			
Rockport						23
Rutland	2	5	8			
Salem						25
Sandwich	2	4	13			
Saugus	2,3,4	5	77			
Scituate	2	5	29			
Sharon	2	5	32			
Sheffield	2	5	11			
Shelburne	2	7	15			
Sherborn	2,3		?			
Somerset	2	5	36			
Somerville	2,4	5	543			45
Southboro						

Biology in Massachusetts Public High Schools (Cont'd.)

1930 - 1931

Town	Year	Periods	Biology	Botany	Zoology	P-H
Shrewsbury	1	5	55			
Southbridge		4	32			
S. Hadley	1,2	5	112			
Spencer				43	45	
Springfield:-						
Central	2,4	5	144			96
Commercial						
Technical						
Stockbridge	1	5	38			
Stoneham	2,4	4	62			
Stoughton	2	5	24			
Stow	1,2	5	?			
Sudbury	2,3	5	20			
Sutton	2,3,4	5	26			
Swampscott	2	5	66			
Swansea	2	5	21			
Taunton	1,4	5	202			
Templeton	2	5	38			
Tisbury	2	5	45			
Topsfield	2	5	6			
Townsend	1	5	13			
Upton	1,2	5	44			
Uxbridge						
Wakefield	2	5	33			
Walpole	2	5	72			

Biology in Massachusetts Public High Schools (Cont'd.)

1930 - 1931

Town	Year	Periods	Biology	Botany	Zoology	P-H
Waltham	2	5	104			
Ware	2	5	55			
Wareham						
Warren	2,3,4	5	31			
Watertown	2	5	102			
Wayland						
Webster						
Wellesley	2	5	60			
Wellfleet	1,4	7	18			
Westboro	2	5	39			
W. Boylston	2		19			
W. Bridgewater	2	5	15			
Westfield	2	5	65			
Westford	2	5	36			
W. Newbury	2,3	5	13			
Weston	1	5	22			
Westport						
W. Springfield	2	5	179			
Weymouth						8
Whitman						
Williamsburg				11	11	
Williamstown	2	5	24			24
Wilmington	2	5	14			
Winchendon	2	5	31			
Winchester	2	5	79			

Biology in Massachusetts Public High Schools (Cont'd.)

1930 1931

Town	Year	Periods	Biology	Botany	Zoology	P-H
Winthrop	2	5	34			
Woburn						76
Worcester:-						
Classical	1	5	116	48		
Commerce				318	61	
North				75	85	144
South				62	47	255
Wrentham	2	5	17			
Yarmouth	2	4	17			

Cassidy

Approved by

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Committee on Thesis.

Date _____